

# PATENT SPECIFICATION

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## (54) CAMERA SHUTTER CONTROL CIRCUIT

(71) We, ASAHI KOGAKU KOGYO KABUSHIKI KAISHA, a corporation organised and existing under the laws of Japan, of 36—9, 2-chome, Maeno-cho, Itabashi-ku, Tokyo-to, Japan, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to an improvement on the current source switch for cameras with an electrically-controlled shutter.

Generally, upon photographing with a camera having an electrically-controlled shutter, simultaneously with the user's depression of the shutter release button a current source switch is closed so that current is supplied to an electric control circuit. Thus the electric control circuit starts operation, and when the exposure is completed the current source switch is opened.

The operation of the current source switch employed for an electrically-controlled shutter has a problem of chattering, that is, for a short time after closure of the current source switch (for example, 10 m sec) the moving contact piece of the current source switch vibrates so that noise is generated which contains frequencies over a wide range. For the short time during which chattering is being produced current supply to the electric control circuit becomes intermittent so that the action of the electrically-controlled shutter becomes unstable.

Conventionally, for eliminating the influence of chattering of the current source switch, a by-pass capacitor is connected in parallel with the current source switch, or alternatively, this capacitor is connected in parallel with the current source terminals of the electric control circuit. Depending upon the structure of and material used for the current source switch, the time pattern and the noise spectrum generated by chattering

vary with individual current source switches.

Generally, a battery for an electrically controlled shutter camera is placed in a limited space within the camera body, so that the load with respect to the capacity of the battery is very high. With the conventional method in which a capacitor is connected in parallel with the current source switch under this load condition, a capacitor of large capacitance is necessary in order to stably supply electric power to the electric control circuit while the current source switch is opened. For this reason the size of the capacitor used becomes large. Further, since in this method the capacitor is short-circuited when the current source switch is closed so that a large discharge current from the capacitor flows through the contact piece of the current source switch, the contact piece of the current source switch is liable to be damaged. Due to the frequency characteristic of capacitors of this type (mainly electrolytic capacitors), in many cases the high frequency component of noise of the chattering cannot be removed. This causes unstable operation of the electric control circuit.

The method of connecting the capacitor in parallel with the electric control circuit has the same drawback. While the aforementioned method utilises the charge characteristic of the capacitor, this method utilises the discharge characteristic of the capacitor. Since in parallel with the capacitor there is connected the electric control circuit which is of unfavourable load condition with respect to the battery, in order to eliminate the influence of chattering on the electric control circuit with greater discharge time constant, it is necessary to have a capacitor of large capacitance. Thus, there remains the drawbacks of the large size of the capacitor, the damage of the contact piece of the current source switch and the noise.

According to this invention there is provided a camera shutter control circuit

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having an electric timing circuit, terminals for connection to a current source, a semiconductor switch element having a control electrode and a controlled current path which is connected between the electric timing circuit and one of the terminals, a mechanical ON/OFF switch, and means connected between the mechanical switch and the control electrode of the semiconductor switch element and arranged to retain the semiconductor switch in its conductive condition after closure of the mechanical switch, whereby chattering of the mechanical switch does not cause detrimental noise frequencies in the current to the timing circuit.

The invention will now be described in more detail by way of example, with reference to the accompanying drawing, which shows the circuit diagram of a camera shutter control circuit embodying the invention.

In series with an electric control circuit 1 for a camera with an electrically-controlled shutter there is connected a transistor 2 which is employed as a direct current source switch. The on-off operation of the transistor 2 is effected by current supply to the base of the transistor 2 through a resistor 5 upon open-close action of a trigger switch 3.

The trigger switch 3 is in driving connection with the shutter release button of the camera and is normally open. Accordingly current is normally not supplied to the base of the transistor 2 acting as a current source switch, so that the transistor 2 remains "off". When the user depresses the release button, the trigger switch 3 is closed so that current is supplied through the resistor 5 to the base of the transistor 2 acting as the current source switch. Therefore, the transistor 2 becomes "on" (conductive), and electric power is supplied to the electric control circuit 1 to make it operate. It is desirable to so select the value of the resistor 5 that a voltage of the value of  $1/3$  to  $1/2$  of the voltage across the battery 6 acts as the trigger voltage of the transistor 2 to turn it "on".

A capacitor 4 is connected in parallel with the series resistance of the resistor 5 and the base input resistance of the transistor 2 and constitutes a discharge circuit of relatively large time constant. When due to chattering occurring upon closure of the trigger switch 3 the latter is instantaneously opened the capacitor 4 discharges slowly. Even if the time during which the trigger switch 3 remains open due to chattering is quite long and the voltage across the capacitor 4 drops, as long as this voltage is greater than the trigger voltage the transistor 2 remains closed in a stable manner.

Thus, even if chattering noise containing frequencies over a wide range is produced

due to vibration of the trigger switch 3 upon closure thereof, noiseless electric power can be supplied to the electric control circuit in a stable manner. Since it is possible to establish the trigger voltage at a value which is substantially lower than that of the voltage across the battery 6, and the sum resistance of the resistor 5 and the base input resistance of the transistor 2 together with the capacitor 4 constitute a discharge circuit, a relatively small capacitance of the capacitor 4 serves the purpose, so that it is possible to make the current charging the capacitor 4 small. Thus, the contact piece of the trigger switch 3 is not damaged.

The above description has been made in connection with an RC timing circuit acting with a retaining function to retain the transistor conductive after closure of the trigger switch. It is clear that the same result will be obtained if another circuit having a retaining function, such as a flip-flop circuit, is connected to the semiconductor switch element. Also, while the above description has been made in connection with a transistor acting as the semiconductor switch element, it is clear that other semiconductor elements such as a field-effect transistor or silicon controlled rectifier may be employed.

The transistor 2, the capacitor 4 and the resistor 5 can be incorporated in the integrated electric control circuit 1 using an integrated circuit technique. Thus, the reliability of the electrically controlled shutter camera is remarkably improved, and also great contribution is made towards ease of mass production.

#### WHAT WE CLAIM IS:—

1. A camera shutter control circuit having an electric timing circuit, terminals for connection to a current source, a semiconductor switch element having a control electrode and a controlled current path which is connected between the electric timing circuit and one of the terminals, a mechanical ON/OFF switch, and means connected between the mechanical switch and the control electrode of the semiconductor switch element and arranged to retain the semiconductor switch in its conductive condition after closure of the mechanical switch, whereby chattering of the mechanical switch does not cause detrimental noise frequencies in the current to the timing circuit.

2. A shutter control circuit according to claim 1, wherein the semiconductor switch element is a transistor.

3. A shutter control circuit according to claim 1 or 2, wherein the said means comprises a resistor connected between the mechanical switch and the control electrode of the semiconductor switch element, and a

capacitor connected across the series-connected resistor and control electrode of the semiconductor switch element.

control circuit in accordance with any of the preceding claims.

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- 5 4. A camera shutter control circuit, constructed substantially as herein described with reference to the accompanying drawing.

5. A camera provided with a shutter

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COMPLETE SPECIFICATION

1 SHEET

*This drawing is a reproduction of  
the Original on a reduced scale*

